Appendix H
WATER SOURCE OPTIONS: RECLAIMED WATER AND AQUIFER STORAGE AND RECOVERY

REGULATIONS AND SUPPLEMENTAL INFORMATION FOR WATER SOURCE OPTIONS

Reclaimed water and water storage via aquifer storage and recovery are two of the water source options being considered in the Lower West Coast (LWC) Water Supply Plan to meet the needs of this region. Both of these options are regulated by the Florida Department of Environmental Protection (FDEP).

Reclaimed Water

Reuse is the deliberate application of reclaimed water for a beneficial purpose in compliance with the FDEP and Water Management Districts rules. Reclaimed water is wastewater that has received at least secondary treatment and is reused after flowing out of a wastewater treatment plant (Chapter 62-610, F.A.C.). Reuse includes the following:

- Landscape irrigation (such as irrigation of golf courses, cemeteries, highway medians, parks, playgrounds, school yards, retail nurseries and residential properties)
- Agricultural irrigation (such as irrigation of food, fiber, fodder and seed crops, wholesale nurseries, sod farms, and pastures)
- Aesthetic uses (such as decorative ponds and fountains)
- Ground water recharge (such as slow rate and rapid rate land application systems)
- Industrial uses (such as cooling water, process water and wash waters)
- Environmental enhancement (such as wetlands restoration)
- Fire protection

The FDEP 1998 Reuse Inventory identified 451 wastewater treatment facilities (≥.10 MGD) statewide that are reusing approximately 490 MGD of reclaimed water in Florida (FDEP, 1999). These facilities have a permitted design capacity for reuse of 1,009 MGD. There have been substantial increases in reuse over the past decade. The 1990 Reuse Inventory identified 199 wastewater treatment facilities that were reusing approximately 266 MGD of reclaimed water (FDEP, 1990). Among the many reasons for the increased utilization of reuse are: (1) it is an environmentally acceptable means of disposal; (2) state regulations have been adopted; (3) there is an increased public acceptance; and (4) the frequency of drought and water restrictions have increased. Treated wastewater, when properly treated to acceptable standards for the reuse, is no longer a waste but a valuable nonpotable water resource that enhances the regional water inventory. Reclaimed water is and will continue to have a substantial role in water supply in Florida.

Reuse in the LWC Planning Area

Nineteen of the regional wastewater facilities in the LWC Planning Area utilized reuse for reclaimed water disposal in 1998. The methods of reuse employed by these facilities included ground water recharge via percolation ponds, public access spray irrigation of golf courses, residential lots and other green space, restricted public access spray irrigation of hay fields, and industrial use. The facilities utilizing reuse for all or part of their disposal needs are listed in **Table H-1**.

Table H-1. Lower West Coast Planning Area 1998 Reuse Facilities.

Wastewater Treatment Facility	Public Access Spray Irrigation			Percolation Ponds	Spray Fields	Industrial
	Golf Course	Residential Lots	Green Space			
Collier County						
Collier County North	x					
Collier County Pelican Bay	x	x	x			
Collier County South	x			x		
Golden Gate				x		
Immokalee					x	
Marco Island Utilities	x	x		x		
Naples	x		x			
Hendry County						
Clewiston					x	
Lee County						
Bonita Springs East and West	x	x	x			
Cape Coral Everest Parkway		x	x			
Cape Coral Southwest		x	x			
Fiesta Villages	x					
Forest Utility	x					
Lee County (Fort Myers Beach)	x		x	x		
Fort Myers Central			x			x
Gateway				x		
Gulf Three Oaks	x					
Lehigh Acres	x			x		
North Fort Myers	x					
City of Sanibel	x			x		

Many of the treatment facilities utilized reclaimed water for plant process water and for irrigation of the plant site, which also could be considered reuse. Reuse of 40.93 MGD of reclaimed water in 1998, accounted for 61 percent of the total wastewater processed in 1998 in the LWC Planning Area. The remaining 25.68 MGD was disposed of by deep well injection or discharge to surface water and lost from the water supply inventory. This water, that was disposed of by deep well injection and discharge to surface water, could have been made available with the addition of regulatory mandated equipment including filtration and the associated chemical feed system, disinfection facilities and reclaimed water monitoring equipment. A required facility reliability of Class I, or an equivalent may exist via their existing method of disposal. In some cases, the existing method of disposal may also be utilized as an alternate means of disposal during periods of low demand or when the required reclaimed water quality is not met, which may negate the need for regulatory mandated storage.

Many of the facilities listed in **Table H-1** will continue to increase their amount of reuse when additional reclaimed water becomes available and/or when demand is created. Utility-specific information is provided in Appendix D.

Florida's Comprehensive Reuse Program

The State and District objectives include promoting and encouraging water conservation and reuse of reclaimed water. To achieve these objectives, several requirements and regulations have been implemented as part of a comprehensive reuse program. These are: (1) Chapter 62-40, F.A.C., (2) Section 403.064, F.S., (3) the FDEP's Antidegradation Policy, (4) guidelines for preparation of reuse feasibility studies, (5) SFWMD Basis of Review, and (6) State reuse regulations.

Chapter 62-40, F.A.C. This chapter, also referred to as the Water Resource Implementation Rule, requires the water management districts to designate areas that have existing water resource problems or areas in which water resource problems are projected to develop during the next 20 years. These were formerly referred to as critical water supply problem areas. This chapter further states that applicants in these areas must make use of a reclaimed water source unless the applicant demonstrates that it's use is not economically, environmentally, or technologically feasible. The SFWMD adopted the designated areas by rule (Chapter 40E-23, F.A.C.) in October of 1991. The LWC Planning Area is incorporated in this designation.

Section 403.064, Florida Statutes. This section of the statutes requires all applicants for domestic wastewater permits from the FDEP for facilities located in water resource caution areas (critical water supply problem area) to evaluate the feasibility of reuse of reclaimed water as part of their application for the permit.

FDEP Antidegradation Policy. This policy is contained in Chapter 62-4, F.A.C., "Permits," and Chapter 62-302, F.A.C., "Surface Water Quality Standards." Compliance with the state's antidegradation policy must be justified prior to issuance of a permit by FDEP for any new or expanded surface water discharge. The antidegradation policy requires a utility proposing to construct a new discharge or expand an existing discharge, to demonstrate that an alternative disposal method such as reuse is not feasible in lieu of a discharge to surface water, and that such a discharge is clearly in the public interest.

Reuse Feasibility Studies. There are several rules, statutes, or laws that require preparation of reuse feasibility studies. The FDEP, with assistance from the water management districts and the public service commission, have developed guidelines for preparation of reuse feasibility studies for applicants having responsibility for wastewater management to aid in coordination, consistency and completeness of these studies. A companion document has also been developed for water use applicants.

SFWMD Basis of Review. Revisions since 1993 to the District's Basis of Review required feasibility evaluations of reuse. For all potable public water supply utilities who control, directly or indirectly, a wastewater treatment facility, an analysis of the economic, environmental and technical feasibility of making reclaimed water available shall be incorporated into their water conservation plan at the time of permit application.

Applicants for permits for commercial/industrial uses, agricultural irrigation, and landscape and golf course irrigation uses that are located in water resource caution areas are required to use reclaimed water in place of higher quality water sources, unless it is demonstrated that its use is either not environmentally, economically or technically feasible. Reclaimed water also has to be readily available for facilities located outside a designated water resource caution areas.

State Reuse Regulations. The state adopted Chapter 62-610, F.A.C., "Reuse of Reclaimed Water and Land Application," in April of 1989. This Chapter contains the specific reuse and land application requirements of the FDEP and the Local Pollution Control programs where such authority has been delegated to those programs.

Reuse Benefits

Several benefits result from the use of reclaimed water for nonpotable water needs. When reclaimed water is utilized to replace a potable supply for nonpotable needs, the benefits include the following:

- Postponement or elimination of future water treatment plant expansions
- Postponement or elimination of construction of additional water supply wells
- Reduction in the size of the potable water distribution lines
- Reduction in monthly water bills

Additional benefits to the above and with respect to other ground water users include the following:

- Guaranteed source of water
- Reduced demand on the ground- or surface-water resource
- Exempt from water shortage/restriction requirements

- Reduced application of commercial fertilizers since reclaimed water contains nutrients
- More water available and reduced demands during water shortages for the regional water supplier
- Ground water recharge
- Satisfaction of antidegradation requirement for expansion of a surface water disposal facility
- Exempt from SFWMD permitting

Public Health

Health risks with reclaimed water are relative to the degree of human contact and adequacy/reliability of the treatment processes that produce the reclaimed water. The FDEP has developed reuse regulations that require extensive treatment and disinfection to assure that continuous and reliable supplies of high quality reclaimed water are produced to ensure that public health and environmental quality are protected. Each type of reuse is afforded an appropriate level of treatment and disinfection. In addition to extensive treatment requirements, several application site standards must be adhered to which also minimize potential health risks. The Florida Department of Health and Rehabilitative Services has concluded that a reuse facility designed, constructed, and operated to meet the requirements of the state's reuse rules poses no threat to public health (Hunter, 1990).

Regulatory Agencies and Requirements

Reclaimed water treatment, quality and use is regulated by the FDEP. The primary document utilized for regulation of reclaimed water and reuse is Chapter 62-610, F.A.C., "Reuse of Reclaimed Water and Land Application". This chapter contains specific reuse and land application requirements of the FDEP and the Local Pollution Control Authority delegated programs providing design, operation and maintenance requirements for land application systems. Chapter 62-610 provides the requirements for reuse via (1) Slow-Rate Land Application Systems; Public Access Areas, Residential Irrigation, and Edible Crops; (2) Slow-Rate Land Application Systems; Restricted Public Access, and; (3) Rapid Rate Land Application Systems; (4) Ground Water Recharge and Indirect Potable Reuse; (5) Industrial Uses. The document specifies the level of treatment required for specific uses of the reclaimed water, the required reclaimed water monitoring equipment, the reliability of the treatment facility, the criteria for the land application system (i.e., golf course, percolation pond, etc.) and system operation.

In addition to Chapter 62-610, F.A.C., the state has adopted the Wetlands Application Rule, Chapter 62-611, F.A.C., which establishes the foundation and criteria for wetlands receiving reclaimed water.

Potential Uses

Florida's water policy states that water management programs shall seek to "encourage the use of water of the lowest acceptable quality for the purpose intended... where economically and environmentally feasible." The District and State support reclaimed water as an appropriate alternate source for irrigation when reasonable and available. There are many uses of reclaimed water as identified previously. A discussion of each follows.

Golf Courses. One of the predominate methods of reuse in Florida is for large-scale irrigation, particularly irrigation of golf courses. Currently, there are approximately 346 golf courses in Florida utilizing reclaimed water for irrigation. In the LWC Planning Area, there are a total of 146 golf courses with a total irrigated acreage of 19,333 acres. The estimated average supplemental (irrigation) water requirements of the existing golf course acreage is 55 MGD. Sixty-two of these courses utilize reclaimed water for all or a portion of their irrigation. The irrigated golf course acreage in the LWC Planning Area is projected to increase to 33,587 acres by the year 2020. The 2020 projected acreage will require an average supplemental irrigation of 115 MGD (see Appendix F for a detailed discussion of demand projections). The city of Naples and the Loxahatchee Environmental Control District (ENCON) are examples of golf course reuse systems.

The City of Naples Wastewater Treatment Facility is a 10.00 MGD facility which provides reclaimed water for irrigation to 15 large users including nine golf courses, two schools and two parks. In 1998, the irrigation sites utilized an average of 3.89 MGD of reclaimed water. Besides providing irrigation water, reuse provides Naples with an environmentally acceptable alternate disposal method to the existing surface water discharge pursuant to a FDEP no-discharge requirement. The reuse system significantly reduces the demand for ground water, which is one of the city's major sources of potable water (Marcello and Chaffee, 1988).

Collier County operates three wastewater facilities with a total treatment capacity of 17.50 MGD that provides reclaimed water for irrigation of 13 golf courses, 5 parks, and approximately 1600 residences. The reclaimed water distribution systems for two of these facilities are interconnect to increase the use of reclaimed water. These facilities reused over 11 MGD in 1998. The use of reclaimed water in this area has significantly reduced the demand for ground water.

Outdoor Residential. It is estimated that up to 50 percent of the potable water delivered to single family homes is utilized for outside uses. This can amount to a considerable volume of water treated to potable standards. A substantial savings in potable water, and in turn ground water, could be realized by utilizing reclaimed water for these outdoor nonpotable water uses. These savings may eliminate the need for expansion of existing water treatment facilities, drilling of new wells, or reduce the need for new facilities. The benefit to the consumer in utilizing reclaimed water are lower monthly water bills, reduced need for fertilizer, and exclusion from water shortage restrictions. Several municipalities, including the cities of Naples and Fort Myers, have adopted ordinances that require new developments over 10 acres to install dual water distribution systems with the anticipation of reclaimed water becoming available in the future. Some Florida communities which have implemented, or which are proposing to implement, residential reclaimed water systems are Cape Coral, St. Petersburg, and Boca Raton.

The city of Cape Coral initiated operation of a system in early 1992 to provide reclaimed water for public access irrigation on residential lawns and other green space via a secondary water line as part of the Water Independence for Cape Coral (WICC) program. As part of WICC, reclaimed water and canal water is used are used as supply sources for the secondary system, which will be distributed throughout the city for residential lawn and other green space irrigation. Approximately 25,000 properties are connected to the system. The city will continue to connect additional users to the secondary system.

St. Petersburg has one of the largest urban reuse irrigation systems in the nation. The program was initiated in the mid-to-late 1970s when the city recognized the need to reduce future potable water imports from adjoining counties. In addition, they were faced with required wastewater treatment facility upgrades because of more stringent water quality standards established for Tampa Bay. St. Petersburg was also declared a water short area (Eingold and Johnson, n.d.). In 1998, the reuse system served over 9,000 residential customers, 70 parks, 46 schools and 6 golf courses. The average reclaimed water usage was approximately 21 MGD. Deep well injection systems serve as an alternate means of disposal for the reuse system. It has been estimated that the reuse program in St. Petersburg has extended the capacity of their potable water treatment and supply system by 15 years (phone conversation March 26, 1991 with Joe Towery, Reuse Coordinator, city of St. Petersburg, Florida).

Other Green Space. This category includes all other green space that requires supplemental irrigation where use of reclaimed water is desirable. This would include irrigation of parks, activity fields, schools, median strips, cemeteries, commercial landscapes, common areas, and retail nurseries. The development of Pelican Bay utilizes reclaimed water to supply their master irrigation system, which supplies irrigation water for residential lawns, median strips, common areas and other green space. In addition, Lee County’s Fort Myers Beach Facility provides reclaimed water to five developments for their green space irrigation needs.

Agriculture. Agricultural irrigation includes irrigation of food, fiber, fodder and seed crops, wholesale nurseries, sod farms, and pastures. State regulations prohibit direct contact of reclaimed water with edible crops that will not be peeled, skinned, cooked, or thermally processed before human consumption. However, if an indirect reclaimed water-application irrigation method is used (such as ridge and furrow, drip, or subsurface), precluding direct contact of the reclaimed water with the crop, irrigation is allowed. There are several agricultural operations that utilize reclaimed water for irrigation throughout the state, including sites in Tallahassee, Orlando, and Okeechobee and Manatee counties. Citrus, gladiolus, sod, ridge and furrow crops, ferns, hay, corn, soybeans, rye, oats, and wholesale nursery plants are some of the crops presently being irrigated with reclaimed water.

The Conserv II Water Reclamation Facility, located in Orange County, is jointly owned and utilized for reclaimed water disposal by both the city of Orlando and Orange County. Conserv II currently provides reclaimed water for irrigation of 7,000 acres of citrus and 10 acres of ferns plus ground water recharge via 2,000 acres of rapid infiltration basins. This site receives reclaimed water from the city of Orlando Sand Lake Road and Orange County McLeod Road wastewater treatment facilities with rated capacities of 21 MGD and 23 MGD, respectively. Conserv II has a capacity to irrigate 15,000 acres and dispose of 50 MGD (Metcalf & Eddy, n.d.).

Industrial. Potential industrial uses of reclaimed water include cooling, process and wash waters. Potential users include power plants, manufacturers such as metal fabricators and plating, cement makers, commercial and institutional facilities. Facilities in Hillsborough and Broward counties, Tampa and Largo use reclaimed water for industrial uses. In certain situations, reclaimed water is not fully consumed in some industrial processes. Proper disposal of this reclaimed water must be satisfactorily addressed. Two examples of industrial facilities that utilize reclaimed water are the Lee County Waste-To-Energy Facility and the Curtis Stanton Energy Center.

The Lee County Waste-To-Energy Facility uses reclaimed water from Fort Myer's Central Wastewater Facility. The system was placed into operation in 1994 and used approximately 0.45 MGD in 1998.

The coal fired Curtis Stanton Energy Center power plant in Orange County utilizes approximately 3.5 MGD of reclaimed water from the Orange County Eastern Service Area Wastewater Treatment Facility for boiler cooling water.

Environmental Enhancement. Reclaimed water could be utilized for environmental enhancement in the restoration of hydrologically altered wetlands. There are several wetlands projects utilizing reclaimed water in Florida, two of which are the city of Orlando Iron Bridge and the Orange County Eastern Service Area wastewater treatment facilities.

The Orlando Iron Bridge Regional Water Pollution Control Wastewater Treatment Facility utilizes a man-made wetlands system for reclaimed water disposal. The 1,200 acre created wetlands consist of a deep marsh, mixed marsh, and hardwood swamp. The current flow into the wetlands is limited to 13 MGD, but ultimately the wetland will receive up to 20 MGD of reclaimed water that has received advanced wastewater treatment. From the created wetlands, the reclaimed water flows through the 660 acre Seminole Ranch wetlands prior to discharge to the St. John’s River. This system was placed into operation in 1987 (Schnelle and Ferraro, 1991).

The Orange County Eastern Service Area Wastewater Treatment Facility utilizes an overland flow and wetlands system to currently dispose of 1.55 MGD of reclaimed water that has received advanced wastewater treatment. The wetlands system consists of 150 acres of natural wetlands and 150 acres of pine flatwood converted to wetlands which discharges to the Econlockhatchee River. The system will have an ultimate capacity of 6.2 MGD. This system was placed into operation in 1988.

Rapid Rate Land Application. Rapid rate land application involves discharging reclaimed water to a series of percolation ponds or subsurface absorption systems (drainfields). The FDEP requires, at a minimum, that reclaimed water receive secondary treatment and basic level disinfection prior to discharge to a rapid rate land application system. In addition, reclaimed water discharged to subsurface application systems must not contain total suspended solids greater than 10 mg/L. The application rate is limited to 5.6 gallons per day per square foot, unless greater loading rates are justified. There are many rapid rate land application systems in operation in the LWC Planning Area, mostly associated with reclaimed water disposal from small wastewater treatment plants. However, several large plants utilize rapid rate land application for their primary method of reclaimed water disposal or as a backup to another reuse system.

Hydrodynamic Saltwater Intrusion Barriers. Reclaimed water could be used for ground water recharge in areas of saltwater intrusion. This would be accomplished via rapid rate land application systems or by shallow injection wells. Rapid rate land application such as ponds or drainfields would be strategically placed to deter further migration of the saltwater front. This could be accomplished by constructing long trenches, percolation ponds or subsurface disposal systems parallel to the saltwater front. Injection of reclaimed water by shallow wells has been investigated on Florida's southeast coast. This method of reuse would consist of construction of several injection wells along the saltwater front, which when in operation, would create a positive freshwater head and impede further migration of the saltwater front inland. Injection of reclaimed water is heavily regulated by state and federal agencies. These agencies' regulations prohibit injection of fluids that do not meet applicable water quality standards. Depending on the local geology/geologic profile and the TDS of the formation fluid, various regulations and criteria apply (FDEP, 1990).

Aquifer Storage and Recovery

Aquifer storage and recovery is one storage option that has significant interest throughout south Florida to meet the growing demands for water, and as alternative to above ground storage. Regional and local applications are being considered and constructed. In the LWC Planning area, ASR facilities have recently been constructed for Marco Island, Collier County and Lee County. There are several others proposed at this time, including using this technology for reclaimed water.

Regulatory Criteria

Guidance for preparation of Class V Aquifer Storage and Recovery injection well system permit applications is provided in a document titled "Guidance for Development of Class V Aquifer and Storage and Recovery Injection Well Systems in South Florida – November 1993" (U. S. Environmental Protection Agency, 1993). This document was prepared by the South Florida Aquifer Storage and Recovery Work Group, which consisted of representatives from the U.S. Environmental Protection Agency, Florida Department of Environmental Protection and the South Florida Water Management District. The following are excerpts taken from that document.

Background

This section outlines circumstances in which a Class V permit would be needed. Aquifer Storage and Recovery (ASR) is the "emplacement of water through the use of an injection well into a suitable aquifer during periods of excess water supply for later retrieval and use during periods of need." Traditionally, public water supply systems employ ASR to store finished drinking water for later recovery and use. ASR can also be used to store excess wet season surface water for later recovery during the dry season as needed to augment drinking water supplies and for other uses, such as agricultural irrigation.

A major impediment to implementing ASR is that the Underground Injection Control (UIC) regulations prohibit injection of fluids into underground sources of drinking water (USDW) if the fluid contains contaminants which violate any federal primary drinking water standard or may adversely affect the public health. If the proposed ASR project will violate any of these criteria, an aquifer exemption must be obtained. In addition to meeting the federal primary drinking water standards, Florida's ground water and UIC rules require that all fluids injected into a USDW meet the secondary drinking water standards and minimum criteria. There are, however, state mechanisms which may be used to grant relief from these requirements when appropriate. A costly way to resolve this dilemma is to treat the surface water to the appropriate standards prior to injection. An alternative may be to inject the water into a deeper portion of the aquifer which contains a total dissolved solids (TDS) concentration of more than 10,000 mg/L. The state has limited experience regarding the success or feasibility of recovery from such zones.

The U.S. Environmental Protection Agency (USEPA) is currently considering revising their policy regarding requirements of water injected into an underground source of drinking water aquifer. These proposed changes were prompted by the incorporation of ASR in the Restudy and in particular, the use of water from Lake Okeechobee as an ASR source of water. Even though this change in policy is in response to a specific project, it may have national and state implications. Specifically, the USEPA is considering evaluating coliform from a public health risk based approach rather than from a formal drinking water standard.

Aquifer exemptions represent major or minor modifications to State UIC programs depending on the level of TDS in the aquifer. If the aquifer which is to be exempted contains water with a TDS concentration of less than 3000 mg/L a major modification is required. Major modifications require notice in the Federal Register and a minimum 30-day public comment period. The state of Florida was delegated primary program responsibility (primacy) for implementing the federal UIC program and follows this process. Minor exemptions require a more limited public notice but still may be difficult to obtain. Under the current state UIC rules only minor exemptions (3,000-10,000 mg/L TDS) are allowed.

Although ASR is generally considered to be a beneficial use of underground injection, concerns with its use include treatment costs, the classification of the ground water and competing uses for the aquifer. Ground water is classified under Chapter 62-

520.410, F.A.C. The fluid injection for storage must meet applicable water quality standards according to the classification. Water may have to be treated to acceptable levels prior to injection. Depending on the source of the water to be stored, treatment costs could be significant. Also, application of the drinking water standards does not give credit for pollutant reductions obtained from the ASR injection process (i.e., bacteria die-off, phosphorus reductions). Current laws do not provide flexibility for addressing this issue.

In some cases, the receiving aquifer for an ASR project is the same aquifer that is being used to monitor for fluid movement at a Class I injection facility. If the ASR and Class I facilities are in the same area, the use of the aquifer for Class I monitoring may be impaired. If this is the case, it may not be possible to obtain an ASR permit in area where a Class I injection well systems is located. A case-by-case evaluation is therefore essential.

Underground Injection Control General Comments

The following comments are provided by the Florida Department of Environmental Protection's Underground Injection Control (UIC) program regarding ASR in general.

> General Comment - ASR Projects - Aquifer storage and recovery is a proven technology for seasonal storage and recovery of potable water. Projects are currently being constructed, or are in the initial stages of testing, for storage of untreated surface and ground water, and reclaimed water. Some 41 ASR projects are in the various stages of permitting statewide.
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> The permitting of ASR projects will be difficult when the water which is to be stored in an underground source of drinking water (USDW; i.e., aquifer containing less than 10,000 mg/L total dissolved solids; TDS) does not meet primary drinking water standards prior to injection. In order to inject water into a USDW that does not meet the federal primary drinking water standards an aquifer exemption will be required. The time needed to obtain an aquifer exemption may be lengthy.
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> Aquifer exemptions are of two types; major and minor. A minor aquifer exemption is needed if the portion of the aquifer to be exempted contains between 3,000 and 10,000 mg/L TDS. If the water quality in the portion of the aquifer to be exempted contains a TDS concentration of less than 3,000 mg/L, a major aquifer exemption is required.
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> Minor Aquifer Exemption - In order to obtain a minor aquifer exemption an applicant must demonstrate that the portion of the aquifer to be exempted contains a TDS concentration of 3,000 - 10,000 mg/L and it is not currently being used for drinking water supply, nor is it reasonably expected to be used in the future for a drinking water supply. Once the Department tentatively approves an aquifer exemption request, the request is then sent to EPA for approval. EPA has 45 days in which to deny the aquifer exemption request or it is approved by default. EPA may approve the request in less than 45 days if they choose. After EPA approval there is a 21-day period in which a party may request an Administrative Hearing.

Major Aquifer Exemption - A major aquifer exemption is required if the portion of the aquifer to be exempted contains a TDS concentration of less than 3,000 mg/L. In order to obtain a major aquifer exemption an applicant must demonstrate that the portion of the aquifer to be exempted is not currently being used for drinking water supply, and it can not now or in the future be used as a source of drinking water because (1) it is mineral, hydrocarbon, or geothermal energy producing, or can be demonstrated by a permit applicant for a Class III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible; (2) it is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical; (3) it is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or (4) it is located over a Class III well mining area subject to subsidence or catastrophic collapse.

Because of the requirements above, it is unlikely any major aquifer exemption could be issued under current regulations and policy. Also, unlike with a minor aquifer exemption, there is no default approval. EPA must approve a major aquifer exemption and there is no time limit in which they must do so. Thus, under the current UIC regulations, ASR projects used to store and recover fluids that do not meet federal primary drinking water standards are practically limited to aquifers containing a TDS concentration of greater than 3,000 mg/L where a minor aquifer exemption can be obtained.

Summary - Treated water ASR systems have proven to be technically feasible and should be encouraged. However, ASR projects using untreated surface or ground water, although technically feasible, may be difficult to permit if all federal primary drinking water standards are not met prior to injection. ASR projects injecting untreated water, especially untreated surface water which is generally high in coliform bacteria, will be very difficult to permit if injection is into an aquifer containing a TDS concentration of less than 3,000 mg/L.

ASR Projects Associated with the Restudy - EPA is allowing the Department to take a more "risk-based" approach to permitting pilot ASR projects associated with the Restudy. Under the "risk-based" approach an aquifer exemption would not be required if total coliform bacteria are the only primary drinking water standard that is not met prior to injection if certain risk-benefit criteria can be met and other water users will not be adversely affected by the ASR project.

Proposed Statutory Revisions - There is currently ASR legislation proposed that, if passed, would allow a zone of discharge for ASR wells injecting into aquifers containing a TDS concentration of 1,500 mg/L or more if certain criteria could be met. If passed, this would eliminate the need for an aquifer exemption if criteria for obtaining the zone of discharge could be met.

However, the ultimate fate of this legislation is unknown. In addition, EPA has stated that if the current legislation is approved the State's primacy for the Underground Injection Control program could be in jeopardy and some environmental groups have weighed in against the proposed legislation.

Types of ASR

There are three basic types or uses for ASR: (1) ASR used to provide potable or drinking water; (2) ASR used for storing raw ground water; and (3) ASR used for storing surface water. Another use that has increasing interest is the use of ASR for storing reclaimed water.

Potable or drinking water during peak demand. Public water supply systems can employ ASR to store finished drinking water for later recovery and use. Water is treated to drinking water standards, stored in the aquifer, and later recovered for use during periods of need.

This is the most common use for ASR. In particular, it is a major benefit to water treatment plants at or near capacity. Stored water can be used during periods of peak demand, reducing the need for increasing plant production capacity. ASR also reduces the impacts on natural systems during peak demand times, particularly when peak demands occur during times of drought.

ASR can also be used as a water storage method to provide an alternative water supply in coastal areas for potential use during emergencies or when regular facilities are not operating. This method can be particularly valuable as a readily available local source of water in emergencies where water lines are destroyed preventing access to regional water supplies (i.e., the Florida Keys). However, disadvantages include costs of establishing the services (capital expenditures) and the unknowns associated with planning for such emergencies.

Raw Ground Water ASR. ASR may be used where “untreated” ground water is stored in an aquifer for later recovery. The advantages of using ground water is that the quality of ground water is less variable over time than surface water, thereby potentially reducing treatment costs. In cases where the ground water quality is good, treatment may not be needed. Limitations include the limited sites available for use and the need to evaluate the water quantity and quality impacts on the natural systems and other users of the shallow water aquifer from which ground water is being withdrawn.

Surface Water ASR. Treated or untreated surface water is stored in an aquifer for later recovery and use. Specific uses of surface water ASR include salinity control, agriculture, and as a storage option for urban supply. This method provides a conservation tool for water quantity (back-up systems), providing recycling benefits, and reducing evaporation losses. It conserves water that would be lost to runoff and can be used later for water supply or natural systems. However, treatment may be required to meet UIC regulatory requirements or an aquifer exemption may be needed.

Reclaimed Water ASR. Reuse systems can employ ASR to store reclaimed water for later recovery and use. Similar to potable water ASR, reclaimed water is stored in the aquifer during periods of low demand and later recovered for use during periods of peak demand. ASR could allow systems to expand the number users they serve where they are limited by reclaimed water availability during certain times of the year.

Project Feasibility

An ASR project must be evaluated in terms of its technical, environmental and economic feasibility. The technical valuation should include a discussion of the appropriateness of the receiving aquifer and address the adequacy of aquifer storativity and transmissivity.

Where applicable, the following environmental effects must be examined: adverse impacts on adjacent aquifers, the lateral and vertical extent of the water quality impacts, effects on nearby surface waters and saltwater intrusion concerns. The effects of the ASR project on existing uses of the aquifer system must also be examined (i.e., monitoring zones associated with existing Class I and Class V wells, existing sources of potable water).

Economic considerations to the facility and the community should be identified, evaluated and discussed. The costs of initial injection and monitor well construction, operation and maintenance (including mechanical integrity testing and ground water monitoring) should be considered when determining project feasibility.

Advantages and Disadvantages of ASR

The following are potential advantages and disadvantages of ASR:

<u>Advantages</u>

- Small-scale land acquisition required, compared to above ground water storage
- No loss of water to evaporation, as compared to above ground water storage, where evaporation losses can be significant
- Ability to locate an ASR facility at the point of need
- Use of recovered water during the dry season does not adversely affect the surficial aquifer, water conservation, or wetlands
- Improved reliability for a utility system in the event of an emergency or drought

<u>Disadvantages</u>

- The quantity of water recovered may be less than the amount injected due to the degradation of the stored water over time
- Increased well maintenance may be needed – formation of deposits, which result from mixing of chemically dissimilar waters, is accelerated

Existing ASR Facilities

Manatee County. In 1978, Manatee County began treated water ASR investigations in cooperation with the Southwest Florida Water Management District (SWFWMD) and CH2M Hill Engineers. This program start up was a direct result of a 1976 CH2M Hill project for Naples, Florida which included two shallow connector wells that recharged the local production zone by gravity from the overlying water table.

The Manatee County Utilities Department has a surface water treatment plant that operates at 54 MGD adjacent to Lake Manatee, which is an impoundment on the Manatee River. An investigation of an artesian limestone aquifer beneath Lake Manatee was conducted which evaluated aquifer hydraulic characteristics such as transmissivity, storativity and leakance. After a series of injection and recovery tests were conducted to determine water quality and percent of water recovered, it was concluded that Manatee County could meet peak water demands as high as 70 MGD without expanding their water treatment plant. The ASR facility is currently in operation, with a rated storage capacity of 316 million gallons. At the end of 1993, 294 million gallons were in storage in the aquifer (phone conversation January 6, 1994 with Bruce McCloud, Manatee County Utilities, Bradenton, FL.).

Peace River. A 12 MGD surface water treatment plant built by General Development Utilities, Inc. (GDU) supplies water to Port Charlotte. Port Charlotte's source of raw water is the Peace River (now owned and operated by the Peace River/ Manasota Regional Water Supply Authority). Due to variations in both water flow and water quality of the river, including occasional movement of saltwater upstream of the plant intake, a 1,920 acre-foot capacity offstream reservoir was constructed for raw water storage. In 1984, GDU was faced with the need to expand their water storage capacity, and as a result, treated water ASR was examined as a potentially less expensive storage option. Two potential production zones were tested to determine if treated water ASR was feasible. Six ASR wells were installed which provide a treated water expansion of 4.9 MGD. Three additional wells are planned for feasibility testing in 1994 (phone conversation January 6, 1994 with Grady Sorah, Peace River/Manasota Regional Water Supply Authority, Port Charlotte, FL.). Over the next 30 years, ASR is expected to reduce capital investment for water supply and treatment facilities for the Peace River by over 50 percent.

Cocoa. The Floridan Aquifer System (FAS) is the source of well water for the Cocoa service area. The wells are located inland as far as 50 miles from some locations in the service area. This great distance is due to saltwater intrusion which is occurring along the coast. The Claude H. Dyal water treatment plant has a capacity of 40 MGD. In 1987 demand had reached 37 MGD, which prompted the city of Cocoa to investigate the potential for treated water ASR as an alternative to water treatment plant expansion.

The success of this test program allowed Cocoa to proceed with treated water ASR and defer a water treatment plant expansion. The system was permitted in 1991 and presently operates at a maximum permitted recovery rate of 8 MGD, utilizing 6 ASR wells (phone conversation January 6, 1994 with Glenn Loffler, Claude Dyal Water Treatment

Plant, Cocoa, FL). Present indications are that plant expansion can be deferred until maximum day demand reached 50 MGD, but an expansion of raw water supply will be necessary to sustain increases in average withdrawals.

Port Malabar. In 1987, the Palm Bay Utility Corporation at Port Malabar began treated water ASR investigations. The Port Malabar development is within the city limits of Palm Bay on the east coast of Florida and obtains its water supply from an intermediate aquifer. At the time the ASR investigation began, water demands were approaching the water treatment plant capacity of 6 MGD and were, at times, equal to wellfield supply capacity. If the treated water ASR project investigation proved successful, it would help Port Malabar meet its upcoming seasonal and daily peak demands and defer water treatment plant expansion.

A test facility was constructed within the Port Malabar distribution system. This location enabled the recovered water to be put directly into a nearby transmission main. The treated water ASR facility was tested and the recovered water met all drinking water standards and required no retreatment other than disinfection. Today, the Port Malabar ASR facility is fully operational and provides an additional 1 MGD of treated water supply during peak demand months.

Boynton Beach. In late 1992, the city of Boynton Beach began testing of its ASR facility. During the wet season, treated ground water from the Surficial Aquifer System is pumped into the upper portion of the Floridan Aquifer System for storage. Upon recovery, the water is filtered and rechlorinated, then used to augment the public water supply during dry periods and during peak demands. This serves to alleviate stress on the Surficial aquifer System which is susceptible to saltwater intrusion.

During a dry spell in May 1993, about 17 million gallons of water were recovered from the ASR system. The single ASR well can provide 2,000 GPM of recovered water, although the city is still gathering information. As of early 1994, five injection/storage/recovery cycles had been completed (phone conversation January 6, 1994 with Peter Mazzella, City of Boynton Beach Utilities, Boynton Beach, FL).

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